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A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

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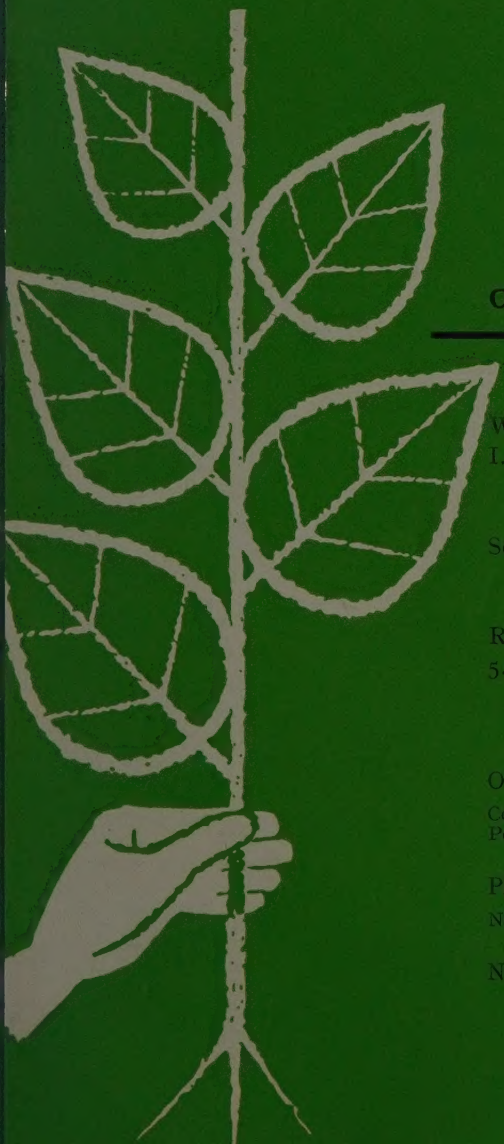

CONTENTS

World citrus problems
I. Aden Protectorate
L.C. Knorr, E.C. Paterson and J. H. Proctor 91

Sorghum red stripe disease in Yugoslavia
Osvaldo Lovisolo and Milivoje Ácimović 99

Recommended analytical methods for pesticides
5. Determination of the particle size of micronized sulphurs
Collaborative Pesticides Analytical Committee 103

Outbreaks and new records 109
Ceylon, Federation of Rhodesia and Nyasaland, French Polynesia, Ghana

Plant quarantine announcements 112
Nicaragua

News and notes 113

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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

World Citrus Problems

I. ADEN PROTECTORATE

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Aden Protectorate, with a population of approximately 950,000 and an area of 112,000 square miles, is located along the southern coast of the Arabian Peninsula, and stretches northeastward from the straits of Bab el Mandeb, at the southern end of the Red Sea (and 20 miles from the eastern coast of Africa), to the borders of Muscat and Oman. Aden Colony, entrepot of the Protectorate, commands the southern entrance to the Red Sea, and because of its strategic importance, has long been the object of conquest. About 24 A.D., a Roman expeditionary force captured the seaport, and Aden subsequently became a stopping-off place on the four-month-long journey from Rome to India by way of Egypt. After the Romans came other conquerors, from Ethiopia, Persia and the Yemen. Marco Polo, arriving in 1285, found Aden a thriving port that dominated the commerce of the southern coast of Arabia. Aden's reputation for its fearsomely hot climate was long rivaled by that of its zealous customs officials who (according to Di Varthema, an Italian visitor about 1504) removed anchors, rudders, sails and masts from incoming vessels in order to prevent their departure before paying harbor taxes. In its long history as a trading and provisioning center, Aden may well have seen the first sweet oranges and lemons as they made their way from the Orient to new homes on the European continent.

Despite its probable connections with the early spread of citrus and its commerce with areas that grew citrus before its introduction into Europe — areas like Calicut, Oman, Mombasa and Malindi — there is no evidence that the Protectorate ever nurtured a citrus industry. At present, trees older than 30 years are not to be found in the area, and the establishment of such limited plantings as do occur have resulted from recent development schemes pioneered by British overseas service officers, particularly B. J. Hartley, C.M.G., O.B.E., and J. L. Congdon.

The number of citrus trees in the Protectorate in 1958 was estimated at about 10,000.[2] Additional trees have been set out since then, but no records are available to indicate the rate of mortality, which in some areas is said to be high. Citrus is grown in the western Protectorate at Lahej, Dhala, Lodar, Dathina, Beihan, Wadi Yashbum and Abyan, and in the eastern Protectorate sparingly along the Wadi Hadhramaut. Its culture is limited — in this land of wadis surrounded by high

[1] Opportunity is taken here to express appreciation for assistance received from many quarters. In particular, expressions of gratitude are due Messrs. K.H.K. Jefferson, Z. Horn, T.W. Hague, G. Henderson, J.C.H. Lanfear, Anwar M. Khaled, Abdullah Shihab, and Mohammed Tayeh. Insects and mites were identified through the courtesy of Drs. Harold Morrison, Louise M. Russell, E.W. Baker, H.H. Keifer, and by the Commonwealth Institute of Entomology, London.

[2] As reported to the first author by J.L. Congdon, formerly Director, Aden Department of Agriculture, in conversation at Addis Ababa, 22 January 1961.

plateaus and mountain ranges — to low and mid-altitude areas where cold is not limiting. And since the country is largely desert (only 1 percent of the total land is considered cultivable), lack of water also restricts the possibilities for growing citrus. What is more, of the water available, only sweet water is tolerated by citrus. Many of the wells in the Protectorate are so salty that agriculture is restricted to the growing of salt-tolerant crops such as dates and small grains.

In planning for the continued development of the Protectorate, the Aden Department of Agriculture has given consideration to an expansion of its citrus industry. To accomplish this on a realistic basis, it decided recently to review prevailing cultural practices in the light of modern concepts and methods of production. The department also deemed it advisable to determine the biological environment peculiar to the southern Arabian peninsula — an area that remains virtually unexplored with respect to problems affecting citrus. To these ends, the Aden Department of Agriculture asked the Food and Agriculture Organization of the United Nations (FAO) for the services of a citrus specialist, and in response to this request, the first author, who was then assigned to the United Arab Republic, undertook a two-week inspection of citrus problems and potentialities in the Aden Protectorate from late January to early February 1961. He was joined in Aden by co-authors, whose intimate knowledge of the area did much to achieve maximum use of the limited time.

Areas visited

On 24 January, a trip was undertaken to El Kod, in the northeast of Aden Colony. El Kod today is the site of an agricultural research station of the Aden Department of Agriculture, staffed by officers of the Empire Cotton-Growing Corporation.

From 25 to 28 January, observations were made in the vicinity of Lodar, 100 air miles northeast of Aden Colony and within a dozen miles of the Yemen border. Here, in the shadow of the Audhali Plateau, whose escarpment rises an abrupt 3,500 feet from the valley floor on which citrus grows, nurseries and plantings of mature trees were inspected. Lodar is the center where citrus nursery stock is propagated and distributed to all parts of the Protectorate.

On 29 January, the citrus trees of Lahej were examined. Lahej, the largest oasis on the plain north of Aden Colony, is situated in the delta of the Wadi Tibban, and provides much of the fresh food requirements of Aden. Of its 21,000 acres under cultivation, about half is devoted to cotton, the other half to fruits, grains and vegetables. Citrus fruits consist chiefly of the *limoon hamid*, synonymous with Egypt's *limoon belady*, South America's *limon comun* and North America's Key or Mexican lime. Citrus trees are not arranged in orchard formation but are scattered among plantings of bananas, dates, guavas, custard apples and Indian almonds.

The first author was in the Wadi Hadhramaut from 30 January to 2 February, evaluating potentialities of that region for the production of citrus fruits. The Wadi Hadhramaut is located in the eastern Aden Protectorate, some 330 miles east of Aden Colony.

Today, the 75,000 square miles of the eastern Protectorate support a population of about 300,000. The chief crops of the area are dates, wheat, millet, indigo and sesame.

Pathological problems

XYLOPOROSIS

Of late, growers and agricultural officials in the Protectorate have become concerned about a decline that affects citrus trees several years after budding and after successful establishment in the field. The first symptom consists of a yellowing of the foliage; later, this assumes patterns resembling those caused by deficiencies of iron, zinc and magnesium. As early as the second year after budding, but sometimes not until a decade later, infected trees become stunted, often to the extent that they are only one third the size of normal trees. Tops ultimately decline to the point where trees are worthless (Figure 1).

Figure 1. Stunting of growth and thinness of foliage in a nine-year-old sweet orange tree on sweet lime rootstock. Presumptive diagnosis of xyloporosis, based on top symptoms, is confirmed by the finding of conoid pits in the woody cylinder of the trunk (cf. Figure 2). Note noninfected, normal-sized tree three times larger in the background. Lodar, western Aden Protectorate.

Various agencies can produce symptoms of stunting and decline, but in the case of the trees in question, evidence was found to implicate the virus causing xyloporosis. Specific and diagnostic symptoms of xyloporosis consist of a pitting in the woody cylinder of the trunk, best seen at the bud union on removal of the bark (Figure 2). Pits are conoid in shape and at times are lined with a yellow- or brown-colored gummy substance. The inner face of the bark bears pegs that coincide and fit into these pits. Symptoms occur either on the scion or the stock portion of the trunk, depending on susceptibility of the variety present. Decline results either when the rootstock is of a sweet lime (syn. Palestine sweet lemon), or when the scion is of a susceptible variety, like certain tangelos (notably Orlando) and *limoon hellew* (the acidless lime esteemed as a table fruit by many people in the Near East and South America). In the case of xyloporosis-affected trees in the Protectorate, it is the sweet lime rootstock portion of the trunk that shows symptoms of pitting and pegging.

Xyloporosis was found to be the cause of decline in various trees at El Kod and at Lodar. The high incidence suggested that at one time susceptible rootstocks had been employed rather generally. Inquiry subsequently revealed that in 1953 a quantity of sweet lime seed had been introduced from Israel. As seedlings of this introduced variety were used for rootstocks, and as xyloporosis virus was present in sources of citrus budwood, a corresponding number of trees became affected by xyloporosis.

The widespread occurrence of the xyloporosis virus in the Protectorate is not surprising. A

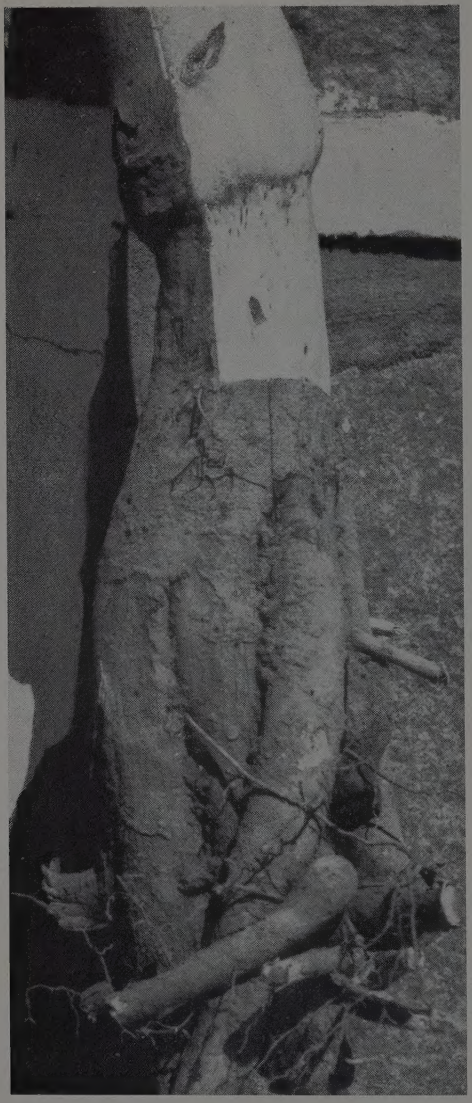

Figure 2. Symptoms beneath the bark of a sweet orange tree affected by xyloporosis. Below the bud union, in the sweet lime portion of the trunk, can be seen the pitting produced by this virus disease. Above the union, an overgrowth of scion tissue occurs, resulting from impediment of elaborated foods by necroses of phloem elements, which in turn prevents translocation of food to the roots, causing starvation and death of rootlets.

recent survey in Florida (1) revealed that approximately 65 percent of the best trees in that state contain the virus. Despite infection, however, trees make exemplary growth only if they are on stocks insusceptible to xyloporosis. Trees on sour orange, sweet orange, rough lemon and Cleopatra mandarin stocks are tolerant to xyloporosis despite the presence of the causal virus, provided scion varieties are also tolerant.

Tristeza

Not all declines in the Protectorate are attributable to xyloporosis. Several other virus diseases exist as well, one being tristeza — the disease which destroyed over 20 million trees in Argentina and Brazil in the 20 years following introduction of tristeza-infected nursery stock from South Africa.

The importance of tristeza to any particular area is proportional to three factors: (*i*) the number of trees on susceptible sour orange rootstock; (*ii*) the presence of insect vectors; and (*iii*) the existence of virus reservoirs. With respect to the first, it is difficult, because of the absence of records, to know how many of the trees in the Protectorate have been propagated on sour orange. Visual inspection, however, indicates that most trees are on that stock. Another susceptible variety is grapefruit, either when used as a stock or as a scion. The infection which tristeza virus produces in grapefruit is known as stem-pitting disease, and it is this malady which in recent years has caused the abandonment of 35 percent of the grapefruit-growing area in South Africa.

In the course of this survey, ten cases of stem-pitting disease were discovered, all of them at Lodar. Affected trees were 15-year-old seedy grapefruit on sweet lime rootstocks. They were severely stunted (Figure 3), bore mature fruits that were no larger than small oranges, showed pitting in the wood under the bark of twigs, and displayed trunks that were characteristically twisted and distorted by the vermiculated channeling of the vascular region, which is characteristic of stem-pitting disease (Figure 4).

Figure 3. External symptoms of stem-pitting disease in a 15-year-old seedy grapefruit tree on sweet lime rootstock. Note small size of mature fruits on the ground. The decorticated trunk of this tree is shown in Figure 4. Lodar, western Aden Protectorate.

The damage caused in these grapefruit trees by tristeza, however, is of minor importance compared to the threat that is posed to neighboring sweet orange trees on sour orange rootstocks. All that is required to reproduce the degree of destruction in a sour orange-rooted plantation, as had been done in Argentina, is to introduce *Toxoptera citricidus* (Kirk.), the very efficient carrier of tristeza virus. At present, this aphid species is not known in the Protectorate, nor did it appear in collections made during the course of this survey. *T. citricidus* does occur, however, in India and central Africa. The cotton aphid, *Aphis gossypii* Glover, another vector of tristeza virus, is also found in the Protectorate, but fortunately, the efficiency of this species in transmitting tristeza is low, and therefore slight difficulty is anticipated for the present.

The presence of tristeza virus in grapefruit trees at Lodar was confirmed in a nearby nursery, where buds taken from affected trees and propagated on sour orange seedlings manifested the typical symptoms of decline in six-month-old buddings that develop in tristeza-susceptible combinations.

There is no indication that tristeza is spreading in the field neither at Lahej, Lodar, Seiyen, Tarim nor Shuhuh. This evaluation is based on an examination of Belady lime trees (*Citrus aurantifolia*); and in no case has vein clearing, which is symptomatic of tristeza, been observed.

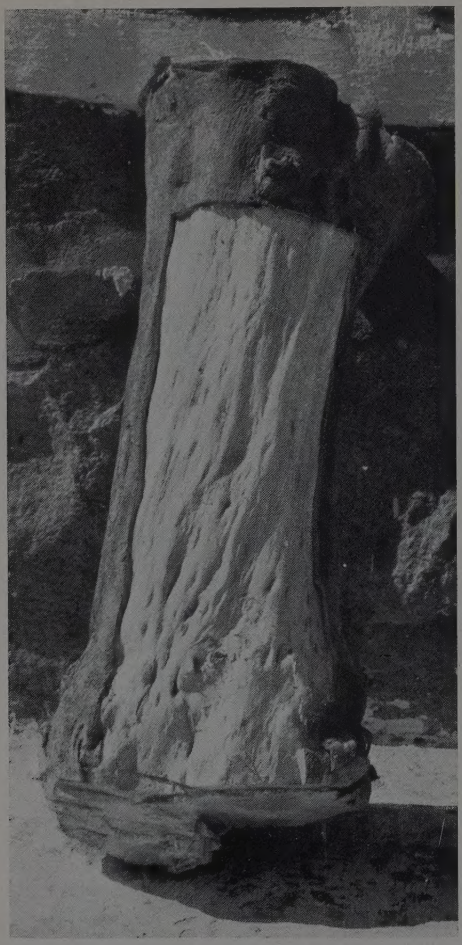

Figure 4. Symptoms of stem-pitting disease in the trunk of a 15-year-old grapefruit tree as shown in Figure 3. Note vermiculate pattern of depressions in the woody cylinder above the bud union and absence of pitting in the sweet lime tissue below. Lodar, western Aden Protectorate.

Psorosis

A third virus disease affecting citrus in the Protectorate is psorosis. As far as world production is concerned, psorosis is probably the most destructive of all citrus viruses. In its eruptive stage, it causes a scaling of the bark and a subsequent deterioration and destruction of infected trees (5). The importance of psorosis lies in its widespread occurrence in citrus groves of the world, and in its attacks on citrus, regardless of scion/stock relationships.

The present survey disclosed half of the 20 trees examined at El Kod to be infected with psorosis virus. Only the early stage symptoms (5) in the foliage were observed. No cases of bark-scaling psorosis were seen, not even in 30-year-old trees. It must be concluded, therefore, that though present, psorosis currently causes little or no damage in the Protectorate.

Bud union crease

Whether bud union crease is a virus disease has not yet been demonstrated, but it is clear that trees showing its symptoms are stunted and in marked decline. At Lodar, a block of 200 nine-year-old sweet orange trees on unidentified rootstock was examined to determine the cause of poor, hard, stunted growth. Of a sample of nine trees, five were found to show the internal gummy constriction encircling the bud union (2) that is characteristic of bud union crease. Adjacent trees of normal development failed to show this creasing at the bud union.

Entomological problems

Aphids

In view of the occurrence of tristeza in the Protectorate, particular attention was paid to Aphididae occurring on citrus. The highly efficient vector, *Toxoptera citricidus*, was not encountered during the present survey. *Aphis gossypii*, however, does occur on citrus, both in the cotton-growing areas of the Protectorate and in certain areas of the Hadhramaut where cotton is not grown, but its efficiency as a vector is fortunately low. Other members of Aphididae found on citrus include *Aphis craccivora* Koch (not yet rated for its ability to transmit tristeza virus) and an unidentified species of *Aphis*.

Serpentine leaf miners

A Gracillariid leaf miner, *Phyllocnistis* sp., occurs throughout the Protectorate, causing an impediment of terminal growth both in

established trees and in nursery stock. According to reports from contiguous Saudi Arabia, serpentine leaf miner (determined by the Entomological Society of Egypt to be *Phyllocnistis citrella* Stainton) currently causes considerable damage to both nursery stock and adult trees.

Infestations of leaf miner at the Lodar nursery were so great that top growth was severely distorted. In a number of heavily attacked trees near El Kod, some 30 percent parasitism was observed by a Eulophid, subsequently identified as *Sympiesis* sp.

Citrus bud mites

Another factor causing damage to the growing tips is the citrus bud mite, determined as *Aceria sheldoni* (Ewing). Together with leaf miners, bud mites produce bizarre malformations of terminal growth at Lodar. Phallic distortions were encountered in fruits of sweet orange.

Black flies

In certain parts of the citrus-growing world, black fly, *Aleurocanthus woglumi* Ashby, is a serious problem; once it has spread, as in Mexico, it is exceedingly difficult to control. Black fly was encountered throughout the Protectorate, giving rise to much sooty mold on the foliage. It was found to be present in large numbers on limes and sweet oranges and to have increased in importance over the past two years, particularly in the Lodar nursery. Small-scale trials have indicated Malathion 50 percent emulsion concentrate at 5 ml. per gallon at high volume to be effective for its control, while Rogor 40, which is systemic in action, is more effective if coverage is not so complete, but may require dosages as high as 40 ml. per gallon.

White flies

In the eastern Protectorate, *Bemisia tabaci* (Genn.), the cotton white fly, was encountered on *Citrus aurantifolia* adjacent to heavily infested *Phaseolus* sp.

Aonidiella scales

Scale insects identified as *Aonidiella aurantii* (Mask.) were found at El Kod on *Citrus sinensis*. Incidence was not high, but scales are capable of sudden and rapid multiplication, therefore they may become destructive to leaves, young wood and fruits.

Aonidiella citrina Coq. was also encountered. At the Lodar nursery, this species was observed to become less important with increase of the black fly population.

Tetranychid mites

The oriental tetranychid mite, *Eutetranychus orientalis* (Klein), was found on citrus throughout the Protectorate; on heavily infested trees, serious amounts of leaf drop occurred.

Brevipalpus mites

Brevipalpus phoenicis (G.) was encountered at Lodar in the western Protectorate and at Seiyun in the eastern Protectorate, in both cases on *Citrus aurantium*. At the former location, it was found to be occasionally associated with *Brevipalpus* gall (4) in sour orange nursery stock.

Brevipalpus obovatus (Donn.), the cause of lepra explosiva in South America, was collected from *Citrus aurantium* at Seiyun, but neither leaf, twig nor fruit lesions were encountered.

Brevipalpus mites of undetermined species were also seen at Lahej on fruits of banana. Cracks along the peel, reminiscent of those associated with *Brevipalpus phoenicis* on fruits of sweet orange, were found heavily infested by these false spider mites. According to reports, cracks allow the ingress of secondary pathogens and lead to the rotting of much fruit.

Mealy bugs

In addition to the above-mentioned instances, sooty mold on citrus leaves is also caused by the mealy bug, *Ferrisiana virgata* (Ckll.). Young crawlers were found to be reduced in number by predation of Chrysopidae. A Psocid, *Pseudocaecilius* sp. n. (?), is often associated with these mealy bugs.

Soil problems

MINERAL DEFICIENCY SYMPTOMS

In parts of the Protectorate, citrus shows various deficiency symptoms, including those of zinc, iron and magnesium. It is not clear from observation alone whether these symptoms result from (*i*) lack of elements in the soil; (*ii*) high pH values making elements nonavailable to plants; or (*iii*) malfunction of roots caused by viruses or fungi, or from asphyxiation — the result of too much irrigation.

ADVERSE WATER RELATIONS

Wherever citrus is grown in systems of diversified agriculture, water needs of the tree crop are usually accorded secondary consideration to those of annual crops. The high water table favorable for growth of shallow-rooted carrots, for instance, is inimical to proper extension of the roots of citrus. Water is also mismanaged when it is allowed to come in contact with the trunks of trees. Wet trunks permit penetration of *Phytophthora* fungi, the cause of foot and root rot. In order to avoid this, mounds of earth should be built close to the trunks, so that irrigation water will not reach the bark. In Lodar, it was observed that cabbages and citrus trees were being grown very improperly in the same manner.

SALT DAMAGE

Citrus is intolerant of salt and should not be planted in certain parts of the Protectorate. In a sense, high salinity on citrus is preferable to medium salinity. It is better to kill trees outright with high salt levels than to depress yields with intermediate ones, to the point where citrus growing becomes nonprofitable.

Conclusion

Many parts of Aden are well situated for the growing of citrus; with proper care, trees make estimable growth. In contrast, for example, to Florida, where despite many handicaps, the world's highest production of citrus is located, Aden has (*i*) mild temperatures that require no firing for frost protection of fruits and trees; (*ii*) an absence of extensive rainy periods which are favorable for the development of melanose, anthracose, scab and russet; and (*iii*) soils that are reasonably supplied with nutrients (as compared to soils in Florida that are 99 percent silica and consequently require yearly additions of all major and most minor elements).

There is sufficient promise of success for the growing and marketing of citrus fruits in the Protectorate to justify correcting the above-mentioned difficulties. Fortunately, in the case of many of these problems, solutions have already been worked out, and it remains but a matter of adapting existing information to local conditions. The area appears capable of at least growing all its own citrus, thus obviating the need of importing large quantities that are at present received from Cyprus and Israel.

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Sorghum Red Stripe Disease in Yugoslavia

Osvaldo Lovisolo, Stazione di Patologia Vegetale, Rome, Italy, and *Milivoje Ácimović*, Institut za Ratarstvo di Novi Sad, Yugoslavia

In mid-October 1960, a disease survey was carried out in sorghum fields, mainly of hybrid forage and grain sorghums, in various parts of the Yugoslav Republics of Vojvodina, Croatia and Bosnia. The survey was organized by Ing. A. Golusić, Director of the Yugoslav Advisory Center for Agriculture and Forestry in Belgrade, with Mrs. Vojislav Novaković, Momćilo Boković, and the authors participating. Among the diseases observed, red stripe appears to be of particular interest. The disease, which had previously been reported only from Italy, is now the most damaging and widespread in Yugoslavia. The presence of this disease in Romania was suspected by Savulescu (6) but has not been confirmed.

Symptoms and host reactions

Characteristic red stripe symptoms were observed in the majority of the places visited on hybrid sorghums, on some volunteer plants of the *Sorghum vulgare* group, and on sweet sorghum. Symptoms of the mosaic type were found in heavily affected fields of *S. halepense* and *Panicum crus-galli*. Most of the diseased plants were infested with aphids, which appeared to be *Rhopalosiphum maidis* (Fitch.).

That the disease on hybrid sorghums, sweet sorghum and *S. halepense* was caused by the sorghum red stripe virus was experimentally established. Symptoms on hybrid sorghums, sweet sorghum and the spontaneous plants of *S. vulgare* were identical with those observed in Italy on *S. vulgare*, manifested by the presence on most leaves, especially younger ones, of red stripes running parallel to leaf veins. The stripes sometimes extended to the leaf sheaths and stalks, and turned into necrotic lesions at later stages (Figure 1). On youngest leaves, chlorotic stripes were usually predominant (Figure 2).

On *Sorghum halepense* and *Panicum crus-galli* only mosaic symptom was usually predominant. The identity of the causal virus in these two hosts was not determined, because the diseased material collected deteriorated before infection trials could be initiated.

Forage varieties of hybrid sorghums, especially Siloking, were most severely damaged. Hybrid grain varieties, such as Ranger, Reider

Figure 1. Red or necrotic stripe symptom of sorghum red stripe disease. Left, on leaf of hybrid sorghum Camelsorgo 59; right, on sweet sorghum.

Figure 2. Mosaic symptom of sorghum red stripe disease. Left, on leaf of hybrid sorghum Camelsorgo 59; right, on sweet sorghum.

and X 3000, frequently showed characteristic symptoms, but the damage did not appear to be serious, as the panicles seemed to indicate a normal appearance. This was probably due to the fact that the infection took place long after the panicles had been formed, and consequently young leaves did not show any necrosis and the stripes on older leaves were bright red.

Susceptibility of some hybrid sorghum varieties to the red stripe virus in the field, as observed in some localities in Yugoslavia, are summarized in Table 1.

The disease was transmitted experimentally to maize variety Mielmais 50, hybrid sorghum variety Camelsorgo 59, sweet sorghum, *Sorghum sudanense* variety Sorgo Gentile and *S. halepense*. Camelsorgo 50 showed characteristic red stripes similar to those observed in the field, and mosaic was present only rarely. Sweet sorghum showed the mosaic symptom more often and red stripe occurred only occasionally. On *Sorghum sudanense* and S. *halapense* mosaic was the constant symptom, which was never accompanied by red stripes or necrosis. Maize variety Mielmais 50 showed light mosaic without necrosis.

TABLE 1. Reactions of some hybrid sorghum varieties to red stripe virus in Yugoslavia

Variety	Percentage of diseased plants at the following localities							Average
	Dolovo	Djakovo	Nova Topola	Rimski Sancevi	Stara Pazova	Tresnje-vac	Coka	
Amak R 10	0	3	1	2	10	6	0	3.1
Amak R 12	2	2	2	0	8	7	0	3
Beefbuilder	0	10	0	0	0	1	10	3
Coastal	0	5	3	—	0	—	0	1.6
C 44 A	—	2	—	—	—	—	—	2
E 56 A	—	2	—	—	—	—	—	2
F 62 A	—	3	—	—	—	—	—	3
F 63 A	—	2	—	—	—	—	—	2
Grazer	2	2	0	—	6	—	0	2
NK 145	0	0	—	0	—	—	—	0
NK 210	0	2	—	0	—	2	—	1
NK 230	4	0	—	20	—	—	—	8
NK 300	5	7	—	0	—	—	—	4
NK 320	0	5	—	0	—	—	—	1.7
Ranger	4	5	5	5	—	13	0	5.3
Reider	5	5	3	—	10	—	5	5.6
Rocket	0	10	2	0	0	—	—	2.4
Siloking	20	20	5	5	10	78	0	19.7
X 3000	—	10	—	0	—	9	—	6.3

Comparison of Yugoslav and Italian isolates of the virus

The Yugoslav isolate of the virus was compared with the Italian isolate studied previously (5) but no significant differences were revealed. Host reactions and symptoms were the same for both isolates. Longevity *in vitro* of the Yugoslav isolate was also similar to that of the Italian. In tests with both isolates, sap extracted from sweet sorghum stored at 17° to 22° C. remained infective after 9 hours but had lost its infectivity after 24 hours. In previous investigations, Lovisolo (5) found that the Italian isolate lost its infective capacity after 2 hours 40 minutes to 4 hours 50 minutes. The difference in results was probably due to the lower storage temperature used in the more recent tests, and possibly to the variation in the sap and concentrations of the virus.

Identity of red stripe virus

Sorghum red stripe was first reported and investigated in 1938 by Goidanich (3), who suspected it to be of virus origin. Later Grancini (4) and Lovisolo (5) independently confirmed that the causal agent is a virus, probably a strain of the sugar cane mosaic virus. Lovisolo regarded the red stripe virus as being related to the sugar cane mosaic virus, mainly on the basis of means of transmission and host ranges. In the laboratory, the red stripe virus could be transmitted by sap inoculation and by aphids but not by seed nor through soil. It could infect sugar cane but not any of the dicotyledoneus plants tested, nor grasses of the tribes Hordeae, Agrostideae and Aveneae. Recently, Dijkstra and Grancini (2) confirmed the affinity between sorghum red stripe virus and sugar cane mosaic virus through serological tests and electron microscopic study of the morphology of the virus particles.

Symptoms similar to those of red stripe were reported on sorghums by Dean and Coleman (1) from the United States. By inoculation with sugar cane mosaic virus, mottling and necrosis were produced on certain sorghum varieties. They suspected that the necrotic reaction of sorghums to sugar cane mosaic virus is probably the same as described in Italy as a symptom of red streak.

Following the assumption that sorghum red stripe virus is a member of the sugar cane mosaic virus complex, it remains to be established whether the virus occurring in Italy and Yugoslavia is identical with one of the known strains of sugar cane mosaic virus. Some observations seem to indicate that it may be a different strain. Among the 72 varieties of sorghum, apparently of *Sorghum vulgare*, which were inoculated with strains of sugar cane mosaic virus in the United States (1), only 21 reacted with necrosis. On the other hand, all the varieties of *S. vulgare* examined by the authors in Italy and Yugoslavia, naturally or artificially infected, displayed red stripes and necrosis; these symptoms were never found on maize, *S. sudanense* and *S. halepense*.

Control measures

Since *Sorghum halepense* and the spontaneous plants of *S. vulgare* were found to be infected with red stripe virus, it appears that these sources, especially the perennial *S. halepense*, are important reservoirs of the virus during the period when no sorghum is cultivated. This fact indicates the need for eliminating the spontaneous sorghum plants in and around hybrid sorghum fields. In addition, the control of insect vectors, especially *Rhopalosiphum maidis*, which is the principal vector of the virus, is highly desirable. The most effective means for combating the disease appears to be the development of hybrid sorghums which are resistant or immune to the virus or to its insect vectors. Preliminary observations indicate that the following hybrids possess to a certain degree the resistance to the infestation of *R. maidis:* NK 145, NK 210, Coastal, NK 320, C 44A, E 56A and F 63A.

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Recommended Analytical Methods for Pesticides

5. DETERMINATION OF THE PARTICLE SIZE OF MICRONIZED SULPHURS[1]

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Introduction

It has long been recognized that micronized sulphurs owe their fungicidal properties to their fine particle size. Such sulphurs must have a minimum of 80 percent of particles of size 12 microns or less, which cannot be determined by sieving.

Two simple procedures are given below for the preparation of cumulative distribution curves for the particle sizes in micronized sulphurs: (*i*) micronized sulphurs without carriers; (*ii*) micronized sulphurs containing carriers.

The method described is based on the rate of sedimentation of suspended particles in a viscous liquid. Reproducible results may only be obtained if the following criteria apply:

(*a*) The powder must be perfectly dispersed in unit particles in the supporting liquid by suitable dispersing agents, so that neither agglomeration nor coagulation occurs which would affect the speed of fall of the particles.

(*b*) The particles must be of the same nature and density; the density of micronized sulphur is 2.

(*c*) The particles must be totally insoluble in the suspending liquid; in the case of sulphur, water can be used.

(*d*) Particles must be nearly spherical, that is to say, there must not be a disproportionate difference in their three dimensions. It is assumed that this condition is fulfilled for micronized sulphur.

(*e*) The concentration of particles in the liquid must be small enough so that their rate of fall is not affected by neighboring particles.

(*f*) The sample taken should correspond to the average composition of the bulk of the material being sampled.

Reagents

Dispersion solution. Dissolve in distilled water (100 ml.), in a beaker on a water bath, sucrose (15 gm.), powdered gum arabic (15 gm.), and phenol (0.1 gm.). Filter through a sintered glass crucible (porosity between 5 and 15 microns) under vacuum, then reduce the volume to about half on the water bath. The viscosity of the paste obtained should not be less than 100 poises and not greater than 600 poises at 18° C. The optimum viscosity is around 300 poises at 18° C.

Apparatus

50 ml. beaker A - squat form, interior diameter 45 mm. (Note 1).

Four 100 ml. beakers B, C, D, D′ - squat form, interior diameter 48 mm. (Note 1).

Beakers A, B, C and D should be tared.

Stirring rod - consisting of a metal rod 20 cm long and 4 to 5 mm. in diameter, fitted at one end with a rubber bung having a diameter of about 20 mm. at the large end and 12 mm. at the small end.

MS 1 Micronized sulphurs without carriers

Principle. The sample is made into a suspension of unit particles, which is then successively decanted into a series of beakers.

[1] This method was accepted in June 1960 as a CPAC method by the Collaborative Pesticides Analytical Committee (CPAC), which consists of scientists from ten European countries having a substantial chemical industry. The original method is in French.

Procedure

(i) *Preparation of sample.* Place in beaker A about 1 gm. of the sample of micronized sulphur without carrier. Reweigh the beaker to find the quantity E of sample taken.

(ii) *Determination of particle size.* Pour into the beaker sufficient of the dispersing liquid (generally about 0.25 ml.) to form a smooth creamy paste with the sample, triturate carefully for ten minutes to get rid of the lumps. In order to avoid grinding the product, use the stirring rod fitted with a rubber bung.

Add distilled water (2 ml.) to dilute the paste and then add a little at a time more distilled water (8 ml.), using the stirring rod to dilute the paste, which is spread out on the walls and bottom of the beaker.

Allow to stand for one minute. Because of the presence of all the dispersing solution in this small quantity of water, the solution is so viscous that it is not possible to use this at the time of the first sedimentation point. Decant by gently tilting beaker A to transfer the liquid to beaker B. The object of this operation is to remove the greater part of the dispersion solution and the fine particles. Add more water (8 ml.) to beaker A. Bring the particles into suspension again with the stirring rod. Allow to stand for eight seconds, while holding the beaker in the hand, and redecant into beaker B, avoiding losing any of the sediment from beaker A. Repeat the whole operation four times more. Little by little the fine particles are removed and there only remain in the beaker particles *whose diameter is, for sulphur (density 2), greater than about 34 microns.*

Take beaker B, which contains between 48 ml. and 50 ml. of liquid, and after stirring, allow to stand for six minutes. After this time, carefully decant the maximum amount of liquid from beaker B into beaker C, taking care as always not to carry over the particles which are in the sediment.

Add more water (50 ml.) to the deposit, stir to bring back into suspension, allow to stand for six minutes, and decant a second time. The deposit remaining in beaker B (interior diameter 48 mm.) is the fraction *whose particle size falls between 12 and 34 microns.*

After stirring, allow beaker C, containing about 100 ml. of liquid, to stand. In order to prevent convection currents, place the beaker in a constant temperature jacket (for example, place the beaker in a water bath in a dark place).

Allow to remain under these conditions for an hour and a half, and then decant beaker C into beaker D. There remains in beaker C (interior diameter 48 mm.) the fraction *whose particle size falls between 4.35 and 12 microns.*

Place beaker D in its turn in the water bath in the dark for 16 hours. After this time decant into beaker D′.

There remains in beaker D the fraction *whose particle size lies between 1.35 and 4.35 microns.*

Dry the deposit contained in each of the beakers A, B, C and D on a water bath, then in an oven at 95° to 100° C.

Place in a desiccator and then weigh.

Replace in an oven and then in the desiccator until the weights are constant. The difference between this weight and the tared weights gives the weight of each fraction.

The fraction containing particles smaller than 1.35 microns remains in beaker D′ and it cannot be evaporated to dryness because of the presence of the dispersing fluid. Its weight is obtained by the difference of the sum of the fractions A, B, C and D and the total quantity of sulphur E′ contained in weight E of the sample taken.

However, it is possible to remove the dispersion solution by centrifuging and washing of the fraction, which will permit the figure obtained to be checked.

To verify the figures obtained, the whole operation should be repeated, using the following times: 8 seconds, 6 minutes, 45 minutes, and 16 hours.

This second determination has the advantage that it will confirm the results obtained during the preliminary determination for the times of 8 seconds, 6 minutes and 16 hours; in addition, it gives a supplementary point

corresponding to 45 minutes for the plotting of the curve.

Note that during the second determination, after 45 minutes standing, there remains in beaker C the fraction of particles *whose diameters fall between 6.10 and 12 microns.*

(iii) *Corrections*

(a) *Diameter of beakers.* The dimension of the particles found correspond to a settling height in the given volume for beakers of interior diameter 48 mm. If the beakers used have a different interior diameter, it is necessary to make a correction to the settling height and to adopt the particle size dimensions given in Table 1 for the times of settling of 6 minutes, 45 minutes, and 1 hour 30 minutes.

TABLE 1. Correlation between the diameter of beakers used and the diameter of particles of micronized sulphurs at the settling times of 6 minutes, 45 minutes, and 1 hour 30 minutes

Interior diameter of beakers in mm.	Minimum diameter of particles in microns at the following times of settling		
	6 minutes	45 minutes	90 minutes
46	12.4	6.4	4.5
47	12.15	6.25	4.4
48	12	6.1	4.35
49	11.65	6	4.3
50	11.35	5.9	4.25

(b) *Temperature.* Temperature has an influence on the viscosity and density of water. It is convenient to carry out the determinations at 20° C. or, alternatively, to apply the following corrections to the dimensions of the particles obtained:

Temperature °C.	Correction coefficient
10	1.14
15	1.07
20	1
25	0.94
30	0.89
35	0.84
40	0.80

(iv) *Calculation*

Let:

E gm. be the weight of the sample taken

M_1 gm. be the weight of the deposit in beaker A

M_2 gm. be the weight of the deposit in beaker B

M_3 gm. be the weight of the deposit in beaker C

M_4 gm. be the weight of the deposit in beaker D

P be the percentage of sulphur in the sample of micronized sulphur, without carrier, determined by analysis (see Appendix 1)

$E' = E \times P$ the weight of sulphur in the sample

The percentage by weight of micronized sulphur whose particle size is greater than 34 microns is equal to:

$$\frac{100\,M_1}{E'}$$

The percentage by weight of micronized sulphur whose particle sizes:

fall between 34 and 12 microns $= \frac{100\,M_2}{E'}$

fall between 12 and 4.35 microns $= \frac{100\,M_3}{E'}$

fall between 4.35 and 1.35 microns $= \frac{100\,M_4}{E'}$

Therefore:

The percentage by weight of micronized sulphur whose particle size is:

less than 34 microns is expressed by

$$100\left(1 - \frac{M_1}{E'}\right)$$

less than 12 microns is expressed by

$$100\left(1 - \frac{M_1 + M_2}{E'}\right)$$

less than 4.35 microns is expressed by

$$100\left(1 - \frac{M_1 + M_2 + M_3}{E'}\right)$$

less than 1.35 microns is expressed by

$$100\left(1 - \frac{M_1 + M_2 + M_3 + M_4}{E'}\right)$$

In the same way a check determination gives the percentages of particles as follows:

less than 34 microns

$$100\left(1 - \frac{M'_1}{E'}\right)$$

less than 12 microns

$$100\left(1 - \frac{M'_1 + M'_2}{E'}\right)$$

less than 6.1 microns

$$100\left(1 - \frac{M'_1 + M'_2 + M'_3}{E'}\right)$$

less than 1.35 microns

$$100\left(1 - \frac{M'_1 + M'_2 + M'_3 + M'_4}{E'}\right)$$

NOTE 1. 100 ml. squat beakers are usually defined by an exterior diameter. In consequence, it often happens that the interior diameters of the beakers B, C, D and D' are not exactly 48 mm. and vary between 47 and 50 mm. In these cases, it is necessary to make a correction to the figures obtained (see method).

MS 2 Micronized sulphurs containing carriers

Principle. A suspension is made of the sample followed by successive decantations as in the case of micronized sulphurs without carriers. Separate determinations for each of the successive deposits are made of the total weight (sulphur plus carrier), then the sulphur contained in each deposit is determined.

These determinations give the particle size of the micronized sulphur and also that of the carrier.

Procedure

(i) *Preparation of sample.* Place in beaker A sufficient of the micronized sulphur containing carrier of the order of 1 to 1.2 gm. Reweigh the beaker to determine the quantity E taken.

(ii) *Determination of particle size.* Carry out the particle size determination as given in the case of micronized sulphurs without carriers. In each of the beakers A, B, C and D deposits corresponding to sedimentation times of 8 seconds, 6 minutes, 1 hour and 30 minutes and 16 hours are obtained.

Determine in each of the deposits the content of sulphur (see Appendix 1). Carry out a check analysis with sedimentation times of 8 seconds, 6 minutes, 45 minutes and 16 hours.

(iii) *Calculation*

Let:

E gm. be the weight of the sample

M_1 gm. be the weight of the deposit in beaker A

M_2 gm. be the weight of the deposit in beaker B

M_3 gm. be the weight of the deposit in beaker C

M_4 gm. be the weight of the deposit in beaker D

P be the percentage of sulphur contained in the micronized sulphur, with carrier, determined by analysis

$E' = E \times P$ gm. the weight of sulphur in the sample

S_1 gm. the weight of sulphur contained in deposit M_1, determined by analysis

S_2 gm. the weight of sulphur contained in deposit M_2, determined by analysis

S_3 gm. the weight of sulphur contained in deposit M_3, determined by analysis

S_4 gm. the weight of sulphur contained in deposit M_4, determined by analysis

The content of micronized sulphur of different particle sizes is reported on the basis of the sulphur contained in the original sample.

The percentage of micronized sulphur whose particle is:

less than 34 microns is given by

$$100\left(1 - \frac{S_1}{E'}\right)$$

less than 12 microns is given by

$$100\left(1 - \frac{S_1 + S_2}{E'}\right)$$

less than 4.35 microns is given by

$$100\left(1 - \frac{S_1 + S_2 + S_3}{E'}\right)$$

less than 1.35 microns is given by

$$100\left(1 - \frac{S_1 + S_2 + S_3 + S_4}{E'}\right)$$

In the same fashion, the check determination gives the percentage of micronized sulphur particle size:

less than 34 microns

$$= 100 \left(1 - \frac{S'_1}{E'}\right)$$

less than 12 microns

$$= 100 \left(1 - \frac{S'_1 + S'_2}{E'}\right)$$

less than 6.1 microns

$$= 100 \left(1 - \frac{S'_1 + S'_2 + S'_3}{E'}\right)$$

less than 1.35 microns

$$= 100 \left(1 - \frac{S'_1 + S'_2 + S'_3 + S'_4}{E'}\right)$$

(iv) *Interpretation of results.* The most practical, if not the best way of using the figures obtained, is to construct a cumulative curve. This gives for any particular diameter the percentage of particles whose size is inferior to that diameter when the abscissae are drawn from the dimensions in microns to the ordinate from the percentage distribution of the particles. (An example is given in Appendix 2.)

Report of analysis

The report on analysis should include all the results obtained. In addition, it ought to include all the operational details which differ from those laid down, and thus include factors which might effect the results.

APPENDIX 1

Determination of sulphur content in the initial sample or in the sediment fractions

There are numerous methods for determining the sulphur content of micronized sulphurs (gravimetric based on barium sulphate, dissolving the sulphur in carbon disulphide, combustion, etc.).

The method based on sodium sulphite improved by Fleck and Ward[2] gives excellent results and also permits rapid and easy determinations of the sulphur contained in the successive deposits.

Principle. The sulphur present is converted to thiosulphate using sodium sulphite and the thiosulphate determined iodimetrically.

Reagents

Sodium sulphite - crystalline
Paraffin - hard or soft
Formaldehyde - 40 percent solution
Acetic acid - 20 percent
Carbon tetrachloride
Iodine - 0.1N solution
Starch - indicator solution

Apparatus

Weighing bottle
250 ml. conical flask fitted with ground neck
Reflux condenser to fit
50 ml. measuring cylinder
Two 10 ml. measuring cylinders
50 ml. burette

Method. Mix the sample thoroughly, weigh accurately sufficient sample to contain 100 mg. of sulphur (w g), transfer to the conical flask, which contains water (30 to 40 ml.), sodium sulphite (2 gm.) and paraffin (about 1 gm.). Attach the condenser, warm gently until all the sulphur has dissolved, then boil the solution for 40 minutes. Cool, and remove the condenser. Add to the solution formaldehyde (10 ml.), acetic acid (10 ml.) and carbon tetrachloride (25 ml.) to remove the paraffin. Titrate immediately with the iodine solution, using starch as indicator if necessary (t ml.), shaking to ensure that the titration is complete.

$$\text{Percentage sulphur w/w} = \frac{t \times 100 \times 3.206}{w}$$

(1 ml. 0.1N = 3.206. mg of S)

[2] Fleck, H.R. and A.M. Ward. 1934. The determination of elemental sulphur. *Quart. J. Pharm. Pharmacol.* 7:179.

APPENDIX 2

Preparation and use of the cumulative curve (see Figure 1)

Assume that the following figures have been obtained in a determination of micronized sulphur without carrier:

less than 34 microns - 99.1 percent
less than 12 microns - 88.3 percent
less than 4.35 microns - 31.1 percent
less than 1.35 microns - 20 percent

The check determination gave the following figures:

less than 34 microns - 98.8 percent
less than 12 microns - 85 percent
less than 6.1 microns - 46.5 percent
less than 1.35 microns - 19.2 percent

Draw the co-ordinates, scale from 0 to 34 microns on the abscissa and from 0 to 100 percent on the ordinate and mark on percentages obtained of less than 34, 12, 6.1, 4.35 and 1.35 microns. It is then only necessary to read on the ordinate of the cumulative curve the point corresponding to a given dimension in order to find the percentage of particles which have smaller dimensions than the dimension chosen. At the 12 micron point, the percentage of sulphur should be 80 or more if the product is micronized sulphur.

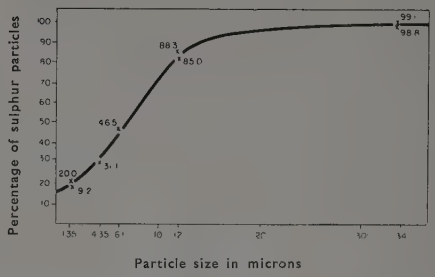

Figure 1. Cumulative distribution curve of particles of micronized sulphur.

OUTBREAKS AND NEW RECORDS

CEYLON

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An unrecorded virus disease of tobacco

A virus disease of tobacco hitherto unrecorded in Ceylon, which is characterized by yellow vein banding, was first observed at Walapane in 1959. At that time only a few infected plants were seen in the tobacco fields, but during the last two years the disease was found in most of the tobacco-growing areas in the central parts of the island, affecting both cigarette tobacco variety Harrison's Special and Bidi tobacco K 49.

Affected plants are only slightly stunted and there is very little distortion or reduction in size of the leaves. The most characteristic symptom is the yellowing, involving veins of the tertiary and lower orders as well as the adjacent lamina. The yellow strips thus formed are discontinuous, measuring 1 to 2 cm. long and 0.5 to 2 mm. wide. Because of the irregular yellow pattern and vein banding (Figure 1), the disease is called Chinese brocade by some farmers.

Attempts to transmit the disease by sap were not successful. On the other hand, the disease was successfully transmitted to healthy tobacco plants by the use of the green peach aphid, *Myzus persicae* (Sulzer). Laboratory-

Figure 1. A. A tobacco plant infected by a hitherto unrecorded virus disease, showing characteristic symptoms. B. Enlarged view showing discontinuous yellow stripes and vein-banding symptoms.

reared aphids were allowed to feed on diseased tobacco plants and then transferred to healthy plants which had been grown under insect-proof conditions. After 24 hours, the aphids were destroyed with a malathion spray and kept under insect cages. All five plants inoculated produced characteristic symptoms, whereas the check plants on which non-viruliferous aphids had been placed remained healthy.

The first symptoms appeared 16 to 20 days after inoculation, in the form of yellow specks on veins of the tertiary and lower orders near the distal end of the growing leaf. As the leaf matured, specks appeared also in the middle and basal areas of the leaf. The specks later developed into yellow vein banding, extending from the distal end to the basal parts of the leaf.

The host range of the causal virus is not known. In the vicinity of tobacco fields, a composite weed, *Ageratum conyzoides*, is commonly found to show the symptom of yellow vein banding. Gadd and Loos[1] reported that the virus of this weed is transmissible to tobacco by a species of white fly. However, the yellow vein banding described by the authors is different from that on tobacco described here. The vein-banding symptom on *Ageratum* extends to all veins, whereas the vein banding on tobacco is confined only to smaller veins. Cross-inoculation of the viruses from the two hosts with aphids has been carried out but infection has not been obtained. This appears to confirm that the virus described here is different from the vein-banding virus of *Ageratum conyzoides*.

Further work will be needed in order to ascertain the identity of the virus on tobacco. Early rouging of diseased plants, elimination of ratoon crops, and suppression of weeds in and around tobacco fields are recommended as control measures.

[1] Gadd, C.H. and C.A. Loos. 1941. A virus disease of *Ageratum conyzoides* and tobacco. *Trop. Agriculturist* 96: 225-264.

FEDERATION OF RHODESIA AND NYASALAND

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New records of two insects infesting pines

Two Lymantriid larvae assumed considerable significance as defoliators in pine plantations near Umtali, Southern Rhodesia, during the second half of 1960.

One of these, *Lechriolepis nephopyropa* Tams, had been found previously but not reared, therefore it has until now been unidentified. It feeds on *Pinus* species, especially *P. patula*, as well as *P. caribaea* and *P. tedae*, and also on some indigenous plants, especially *Brachystegia spiciformis* and *Stoebe vulgaris*.

The other insect species, *Orgyia basalis* (Wlk.), is very selective, feeding almost exclusively on *Pinus patula* and rarely on other species of *Pinus*. It has not previously been noticed.

Both of these species are presumably indigenous and have seemingly become evident as a result of intensive growing of a suitable food plant. They both appear to have several broods in the rainy season and few parasites, so that a rapid increase in population is likely. They do not seem to have been recorded as being of economic significance elsewhere.

FRENCH POLYNESIA

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Spread of two coconut pests

Brontispa longissima Gestro. This beetle has been introduced in recent months into French Polynesia from New Caledonia. It is a serious pest of the coconut and some ornamental palms. The presence of *B. longissima* in Tahiti is a serious threat to the coconut cultivation of the whole of Polynesia, where coconut is one of the main food crops.

The known distribution area of *Brontispa longissima* includes Java, Celebes, the Moluc-

cas, New Guinea, the Bismark Archipelago, the Salomon Islands, New Hebrides, New Caledonia and Tahiti, and it is suspected to occur in the Cape York Peninsula, Australia. The recent discovery of this pest in Tahiti extends its distribution area over 4,000 km. to the east.

Aspidiotus destructor Sign. This Coccid has been introduced recently into New Caledonia, where it was first recorded in March 1961. Its origin is uncertain, for it occurs on the neighboring Fiji Islands and was reported in 1959 from the Wallis Islands. However, it seems likely that it was introduced from French Polynesia, because there has been extensive traffic of certain plant materials between Tahiti and New Caledonia, where the plant protection services are rather inadequate.

Aspidiotus destructor seems to be spreading in the South Pacific. At present it is known to occur in the Mariannas Islands, Guam, Caroline Islands, Territory of Papua and New Guinea, Solomon Islands, Western Samoa, French Polynesia and the Wallis Islands, as well as New Caledonia.

GHANA

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Two new hosts for *Trachysphaera fructigena*

Infection by *Trachysphaera fructigena* Tab. & Bunt., a pathogen of coffee, banana and cacao, has been recorded on very few hosts of lesser economic importance. Two further hosts were discovered at Aburi, in Ghana, when the fruits of two species of *Mimusops*, *M. elengi* L. and *M. commersonii* Engl., were found to be quite heavily attacked by the fungus. Both species provide new host records for the fungus in Ghana, and available literature shows no record of the fungus on these hosts elsewhere. The infections were characterized by the formation of smooth, white, circular or ovoid, erumpent blisters, formed subepidermally on the fruits. On *M. commersonii*, which has the larger fruit of the two species, the lesion size was up to 2 cm. in diameter. Within the lesion, the cavity was filled by a mass of sporangia which caused the dense white coloration. Spore liberation was apparently by epidermal rupture, as older lesions were bordered by fragments of the dead residual tissue. Microscopic examination of the pathogen showed it to be identical with the fungus from cacao in Ghana, where the pathogen was originally recorded and described.

PLANT QUARANTINE ANNOUNCEMENTS

NICARAGUA

Regulations concerning the importation and transit of coffee, dated 12 December 1960, were published in *La Gaceta* Vol. 65, No. 70 on 23 March 1961, when they came into force. The regulations are aimed at the exclusion of coffee berry borer (*Stephanoderes hampei*) and coffee rust (*Hemileia vastatrix*).

Entry requirements

Importation of coffee beans, fruits or berries, plants or parts thereof is prohibited, unless the following requirements have been met:

1. Coffee seeds or beans that have been roasted should have all the noxious organisms destroyed. Upon arrival, consignments are subject to inspection and treatment.

2. Coffee samples and coffee seeds or beans require import permits. These should be obtained in advance from the Plant Protection Department. The consignment must be accompanied by a phytosanitary certificate issued by the country of origin, indicating that the consignment has been fumigated. It should also include particulars of the fumigation. Upon arrival, coffee samples and seeds or beans are subject to inspection and treatment. Coffee samples must not exceed ½ kg. each.

3. Coffee plants or parts thereof may be imported for experimental or scientific purposes only by the Ministry of Agriculture or by scientific and educational institutions, under a special permit issued by the Plant Protection Department.

4. Unwasted coffee beans or seeds intended for importation must be packed in new bags or packings. No bag or other coffee container will be released at the point of entry unless a written permit has been issued by the quarantine inspector.

Imports requiring intermediate quarantine

Importation of unroasted coffee beans, coffee berries and coffee plants or parts thereof from Brazil or other countries where *Hemileia vastatrix* or *Stephanoderes hampei* occurs is strictly prohibited, unless they have been introduced through an approved intermediate quarantine center where freedom from pests and diseases may be certified.

Transit

In-transit shipments of coffee beans or seeds from any country are permitted only if permission has been obtained in advance from the Plant Protection Department and if the consignment is accompanied by a phytosanitary certificate issued by the country of origin, indicating that it has been fumigated, and should include particulars of the fumigation. All in-transit shipments are subject to fumigation and treatment.

NEWS AND NOTES

FORTHCOMING FAO MEETINGS

The Fourth Meeting on the Control of the Sunn Pest will take place at Tel-el-Amara, Lebanon, 11-16 September 1961. Previous meetings on the same subject were held in Ankara, Turkey, in 1956; in Teheran, Iran, in 1958; and in Meknès, Morocco, in 1959.

At the meeting, the current status of infestation in affected countries will be reviewed and the progress in the investigations on the biology and control of the pest will be reported. Intergovernmental co-operation in research has been strengthened by the provision of technical assistance by the Food and Agriculture Organization of the United Nations (FAO), including the development of an information and documentation service and the provision of experts. These FAO projects will be continuing into future years, and the possibility of obtaining further assistance for the promotion of regional research activities will be examined. Co-ordinated research programs on chemical and biological control for the following two years will be formulated at the meeting.

The First Plant Protection Meeting for the Near East will be held in Damascus, 18-22 September 1961. Recognizing the need for an effective means of promoting and co-ordinating general plant protection activities in the Near East, governments have requested FAO to hold a technical meeting to consider the formulation of a regional plant protection agreement, the strengthening of national plant protection services, and the possibility of obtaining assistance from various sources to develop regional activities. Since FAO projects on desert locust, sunn pest and olive fly have achieved significant results in the Near East and adjacent regions, this meeting is convened in the hope of bringing about similar achievements on the control of other destructive pests of regional importance and on general plant protection activities, such as plant quarantine. A preliminary survey on present plant protection organizations and the progress achieved was carried out in 1960 and the report will constitute a basis for discussions at the meeting.

The First Meeting of the FAO Working Party on Coconut Production, Protection and Processing will be held in Trivandrum, India, 27 November-2 December 1961. As diseases and pests are often the limiting factor in coconut production, the major items of discussion at the meeting will concern coconut protection. Among diseases, those of undetermined cause, such as cadang-cadang of the Philippines, wilt disease of India, lethal yellowing, frond-drop and bronze leaf wilt of West Indies, and Kaincopé disease of western Africa, will receive particular attention. Much concern has been expressed recently regarding these diseases because of their widespread occurrence and destructiveness, but research to determine causes and means of effective control have not yet been systematically organized. Plans for the establishment of a co-ordinated research program will be considered at the meeting. Among

the insect pests, Rhinoceros beetle and its control, mainly by biological means, will be fully considered. Recent efforts toward the development of coconut varieties resistant to diseases have significantly increased international traffic of seed nuts. In order to safeguard coconut production, effective quarantine measures will also be discussed at the meeting.

The Working Party on Rice Production and Protection of the International Rice Commission will hold its ninth meeting in New Delhi, India, 11-16 December 1961. Among the problems concerning rice protection, measures for reducing losses in storage will be given major attention. These include fumigation and other chemical treatments for infestation control, rodent control, and drying, aeration and other practices, for the prevention of spoilage and loss in quality. Standardized methods for determination and expression of losses in storage will also be considered.

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IMPROVEMENT IN OLIVE CULTIVATION

FAO Agricultural Studies No. 50

Recognizing that the economic sources of olive plantations must depend entirely on the improvement of cultural practices, this publication, while reviewing existing knowledge on olive production, attempts to illustrate ways and means of achieving such improvement. Results of research and experiments conducted by many experts in olive growing have been drawn on extensively in compiling the work.

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